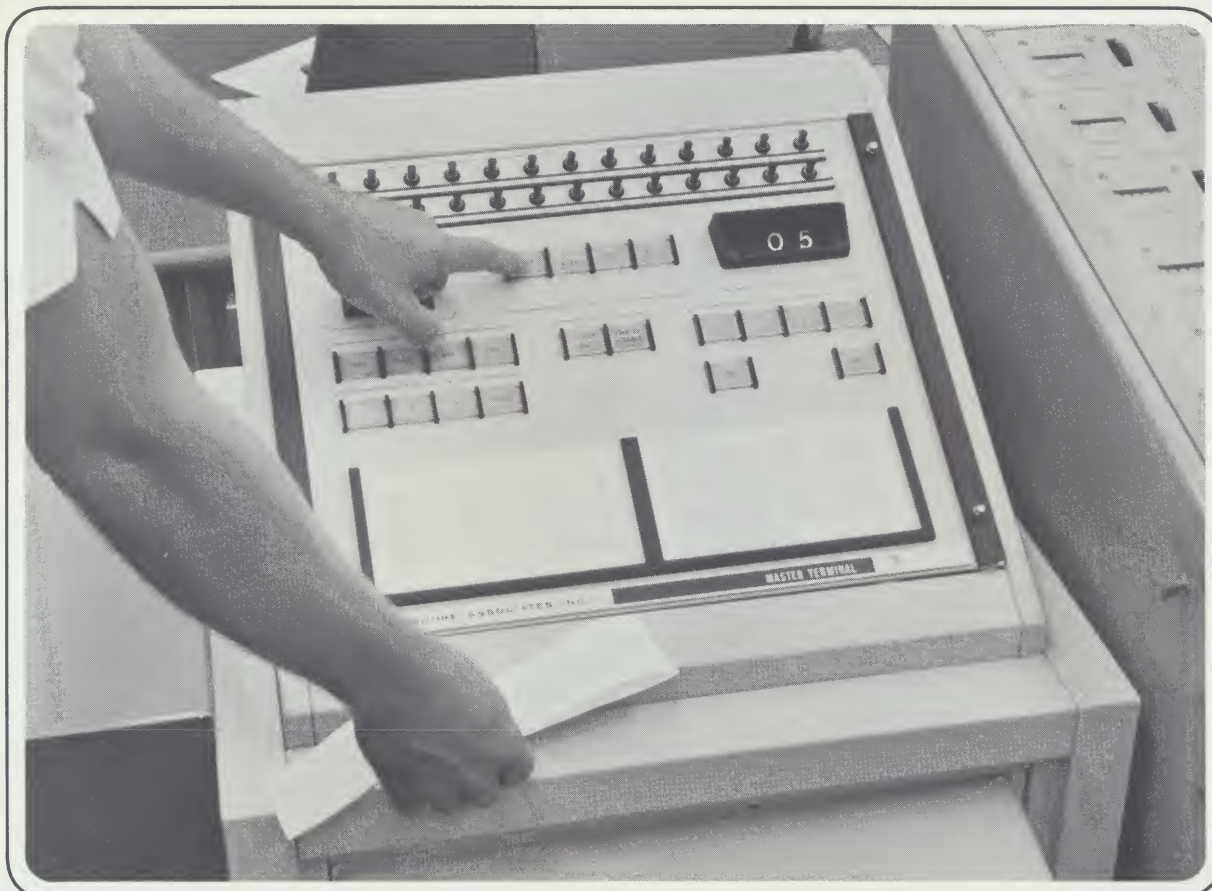




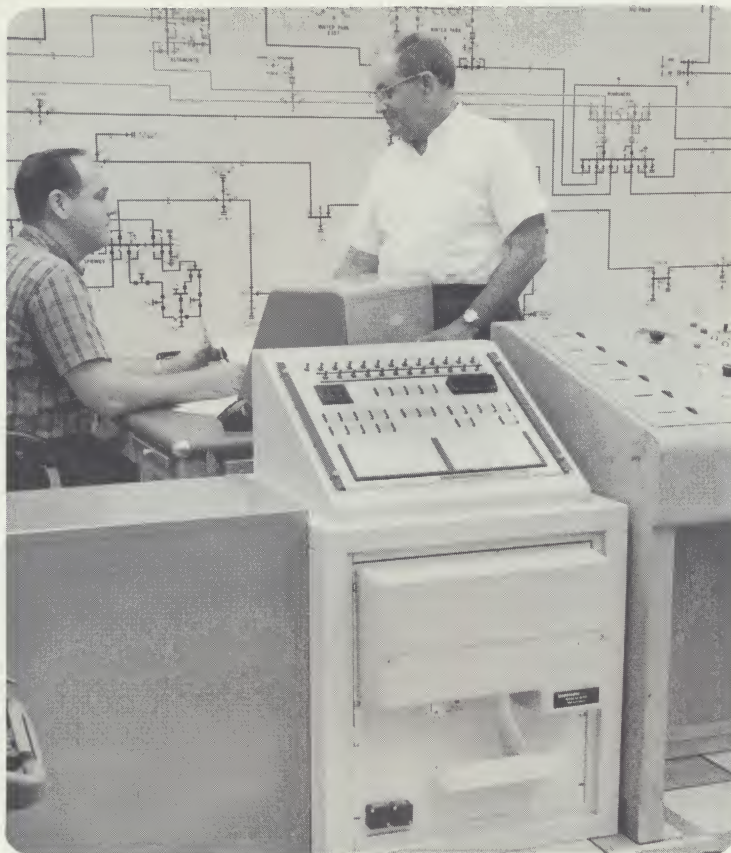
Moore Microwave Alarm System at Florida Power Corp.

The Florida Power Corporation employs a Moore Alarm System, MARC ALN 1565, for alarm and control of its 850-mile microwave system, and for power station supervision throughout central and west coast Florida. The basic installation serves fifty remote stations, and forty-nine more can be served without modification to the master station. The MARC ALN 1565 system also provides for the future requirements of this fast-growing utility, by permitting the system to be expanded to a total of 255 remote stations simply by the addition of plug-in circuit cards. Each remote station has a full capacity of 24 alarms, plus 4 control selection and 2 control actuation functions.

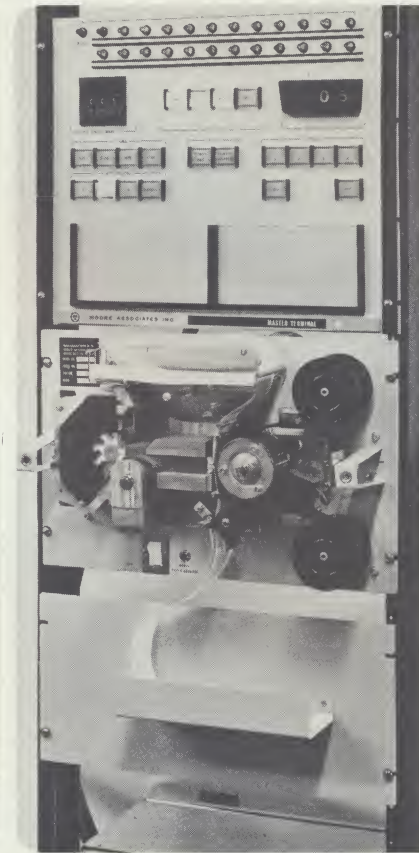
The system meets or exceeds the ten fundamental requirements set forth by Florida Power: 1. Party-line operation, with remote tone transmitters normally silent; 2. Periodic automatic

interrogation of remote terminals to determine operational capability (Fail Safe); 3. Automatic reporting from each remote terminal whenever there is any change from alarm to normal or from normal to alarm; 4. Memory at the remote terminal to assure that the momentary alarms are reported and printed at the master terminal; 5. Automatic printing of all remote changes to assure complete printed record; 6. Solid-state design throughout to assure system reliability; 7. Coding security to prevent false controls or indications due to line noise and substation transients; 8. Basic capability for 99 remote stations with additional expansion capability by plug-in means to 255 remote stations; 9. Automatic deciphering of multiple simultaneous transmissions without operator intervention; 10. Positive lockout for remote station during interrogation and/or control by master station.





Initial installation has 50 remote stations; 49 more can be added without modification to Master Station.



Master Terminal, prior to final installation, with dust cover removed to show high speed Tape Printer.

Operation of the Florida Power MARC ALN System

The remote terminals of the network report their alarm and status indications by means of binary codes which modulate frequency-shift tones carried by the microwave system. The tone transmitter at each remote terminal is silent until the terminal is interrogated, or until a change occurs in the terminal's inputs. When an input change occurs, remote terminal repeatedly sends its station address to the master terminal. When the remote terminal is interrogated, it replies with its address, plus twenty-four indications. Interrogations and commands from the master terminal are also transmitted by binary codes which modulate frequency-shift tones carried by the microwave system. The tone transmitter at the master terminal is also normally silent.

When a single remote terminal sends in its station address (indicating an input change), the master terminal automatically sends an interrogation message to that remote terminal. The presence of a tone from the master terminal causes all remotes to be silent. After recognizing its unique interrogation message from the master terminal, the interrogated remote again generates its coded tone and reports its address and

the status of its indications. The master terminal reacts by automatically sounding an audible alarm, displaying the remote station's number (digital display) and alarms (individual lamps), and automatically logging the day of the year, the time, the station number, and all of the indications, by means of a high speed tape printer. When the operator sends a command or interrogates a remote terminal, the same sequence is followed, except that transmission is initiated by the master rather than by the remote.

When two or more remote terminals attempt to report simultaneously, their signals clash and the error detecting circuits in the master terminal reject both messages. The master terminal then begins a "clash roll call." This is a form of system check whereby each remote terminal is automatically interrogated and its indications are displayed and logged. The messages of the "clashing" stations are picked up in the roll call. The roll call operation can also be initiated and stopped manually, or can be initiated on a routine basis by the digital clock. Available intervals on the clock are once every hour, once every two hours, and once every four hours.

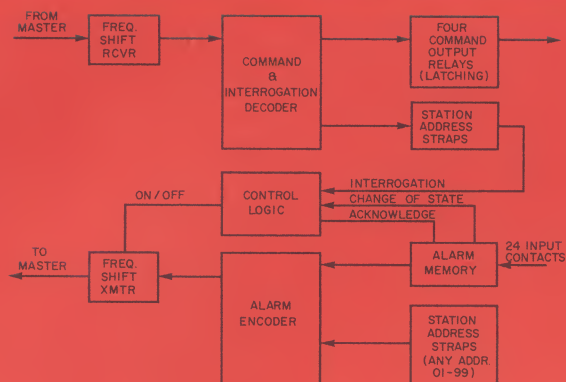


Figure 1.

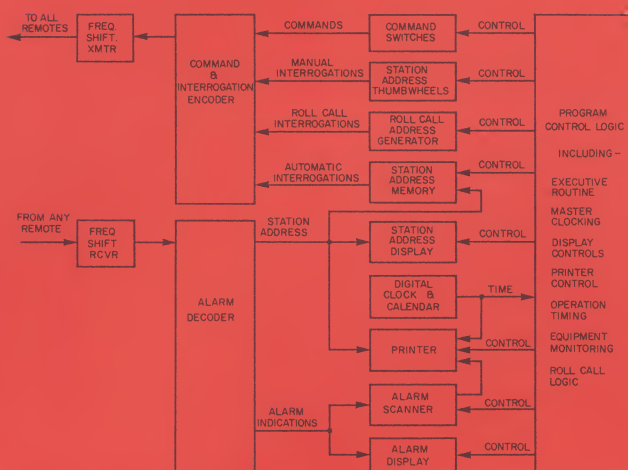


Figure 2.

Using the Display Panel

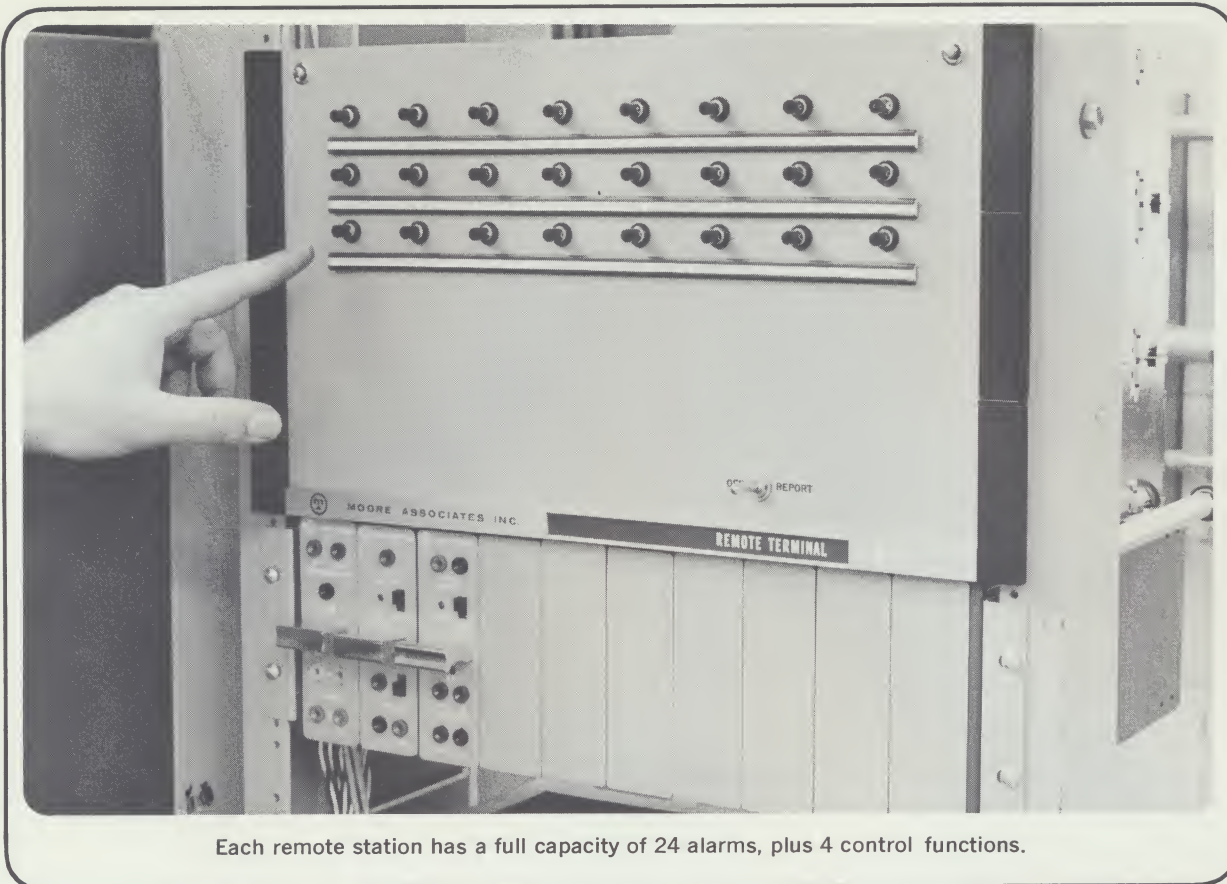
While the MARC ALN 1565 system is designed to operate automatically, a display panel is provided to permit the operator to select the operating mode of the system, to interrogate stations, to send commands, and to monitor the system's performance. The display panel also functions as a back-up for the printer.

The panel includes a digital display for station address (1 through 255) and 24 alarm lamps. When a station reports automatically, the audible alarm sounds and the station's address and alarms are displayed. After the operator resets the audible alarm, the address and alarm displays automatically go dark, unless the "hold" button is depressed. Operator obtains a display and printout of a particular station's alarm by selecting that station's address by means of a thumbwheel switch and pushing the "Xmit" pushbutton.

Four point-selection pushbuttons plus com-

mon "off" and common "on" pushbuttons, are provided for sending commands. To send a command, the operator selects the station with the thumbwheel switch, pushes one of the four point-selection pushbuttons, pushes either "on" or "off," then pushes "Xmit."

To initiate a printout of all alarms at all stations the operator depresses the manual "roll call" pushbutton. He can stop the "roll call" before it is complete by depressing "stop." If a "roll call" is initiated by the digital clock, the "AUTO" indicator lights. There is a "CLASH" indicator light to note an attempt by two remotes to report at once. Pushbuttons engraved 1, 2, 4, and DISABLE are provided to select the automatic roll call interval in hours. Other indicators report signal failure, equipment failure, power failure, printer failure, alarm, equipment at reset, and printer disabled.



Each remote station has a full capacity of 24 alarms, plus 4 control functions.

System Components

Except for tone transmitter and receiver, all of the remote terminal elements shown in the block diagram (Fig. 1) and an AC or DC power supply, as required, are combined in a 10½" high rack mountable unit, the Model 1565A Remote Terminal. While the 1565A is wired for 24 alarms, it can be ordered equipped for 16 or 8.

The Master Terminal consists of a sloped front console, which houses the display panel and printer, and an equipment rack. The two units are connected by plug-in cables. The physical elements of the master terminal are as follows, see block diagram (Fig. 2):

- a. Sloped front electronic enclosure
- b. 6' high electronic enclosure
- c. Interconnection cable
- d. Display panel #3407-5 (includes command switches, station address thumbwheels, station address display, alarm display, and miscellaneous devices)
- e. Printer (Monroe MC 10-40)
- f. Digital Clock, Model 810C-4

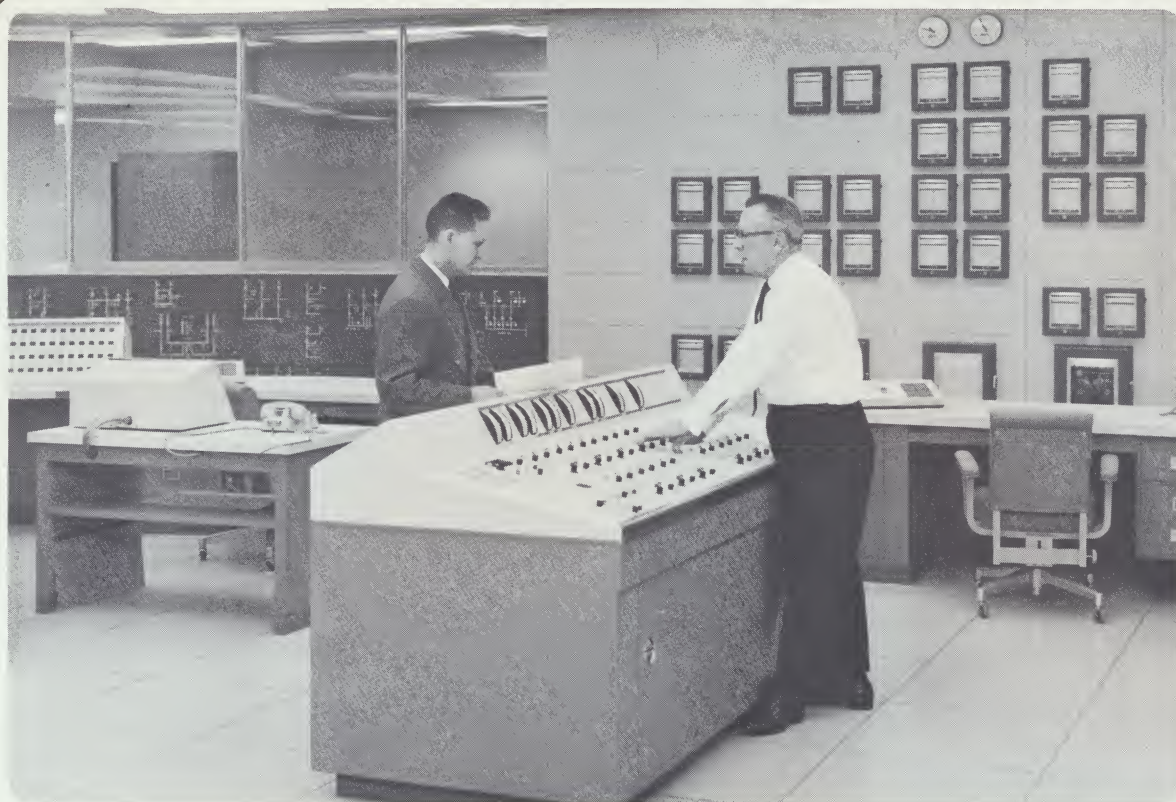
- g. Power Supply — 115 VAC input, 24 VDC output
- h. Power Supply — 115 VAC input, 12 VDC output
- i. Power distribution and fuse alarm panel #3524-3
- j. Duplex FSK tone channel terminal
- k. Multiplex Unit 1565C (includes command and interrogation encoder, alarm decoder, station address memory, alarm scanner, communications interface)
- l. Programmer, 1565D (includes program control logic, roll call address generator, etc.—see block diagram)
- m. Set of rack cables

OPTIONAL:

The master terminal is equipped for up to 99 remote terminals. The addition of a Model 1565B Converter will increase the master terminal capacity to 255 remote terminals.

MOORE ASSOCIATES, INC.





Union Electric Company Load Dispatch Center, showing Analog Computer and portion of semicircular LDO map board.

Tampa Electric and Union Electric use Moore Monitoring and Control Systems

The extreme versatility of Moore Systems is demonstrated in the application of MARC ALD System components in major systems for Tampa Electric Company of Tampa, Florida and Union Electric Company of St. Louis, Missouri. In each case, standard MARC components were employed as modular elements to tailor master and remote stations to individual requirements.

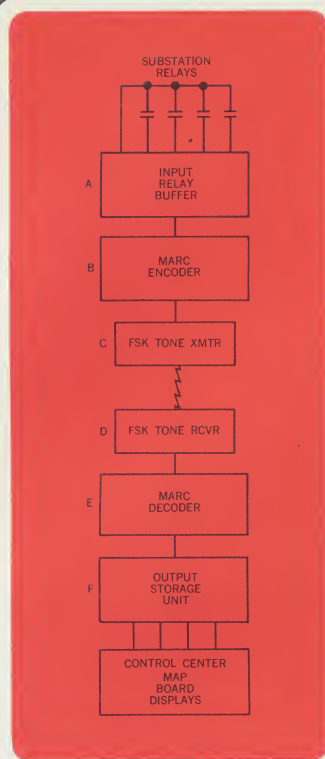
In the case of Tampa Electric Company, substation alarms to be monitored varied from 6, at the smallest substation, to 100 at the largest. Modular preplanning resulted in simplicity and design similarity throughout the complex of stations. Four of the sixteen substations installed by Union Electric Company are equipped for the remote control of M-G sets, rotary converters, and rectifiers. Modular design permits the extra control elements to be relocated to new substations to perform alarm monitoring, as the control requirement is phased out at these initial

substations.

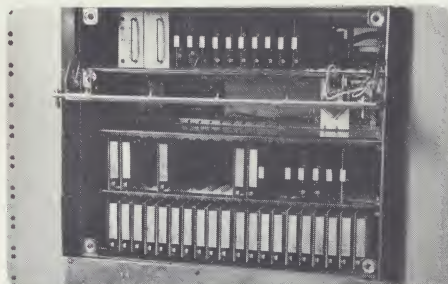
MARC ALD Systems are characterized by high reliability and security, a prime necessity for power utility service. They are further typified as highly flexible, modular elements; expandable through the addition of circuit cards and readily available from off-the-shelf inventory to satisfy requirements for alarm indication, supervisory control or digital telemetering. Request "Catalog 6502A, MARC Time Division Multiplex Systems."

All components are of solid-state design, to provide maximum long-term reliability, and extensive error-checking techniques are employed to assure maximum security and accuracy in operation. The systems are designed for easy installation and adjustment, and require no routine maintenance whatsoever. Typically, customer personnel, factory trained by Moore Associates, handle all installation and trouble-shooting from the date equipment is received.

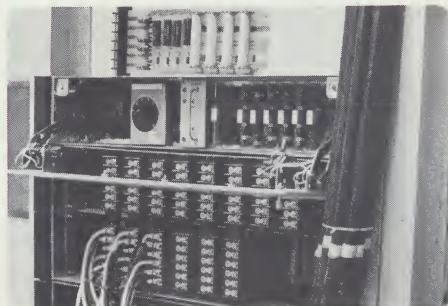




Block diagram of MARC ALD system.



One-hundred-function Decoder/Output Storage package with front panel removed . . . Mercury wetted output relays are mounted eight functions to the card.



Input Relay Buffer Packages. Remote alarm point inputs are wired to barrier strips on front of circuit card. See typical card on top of package. This equipment is located at a remote Tampa Electric Company terminal.



"Rackup" at Tampa Electric Company master terminal. . . Bottom package on rack, occupying 14" vertical rack space, is the 100-function Decoder Output Storage package.

Substation Monitoring Systems for Tampa Electric Company

Tampa Electric Company serves a part of the rapidly expanding Central West Coast area of Florida. With an anticipated growth rate of 10% per annum, this company has an increasing need for information gathering systems for the centralization of data, in order to achieve maximum efficiency and economy of operation. Operational details of the system utilized by Tampa Electric Company are described in the following paragraphs, with references to the block diagram on this page.

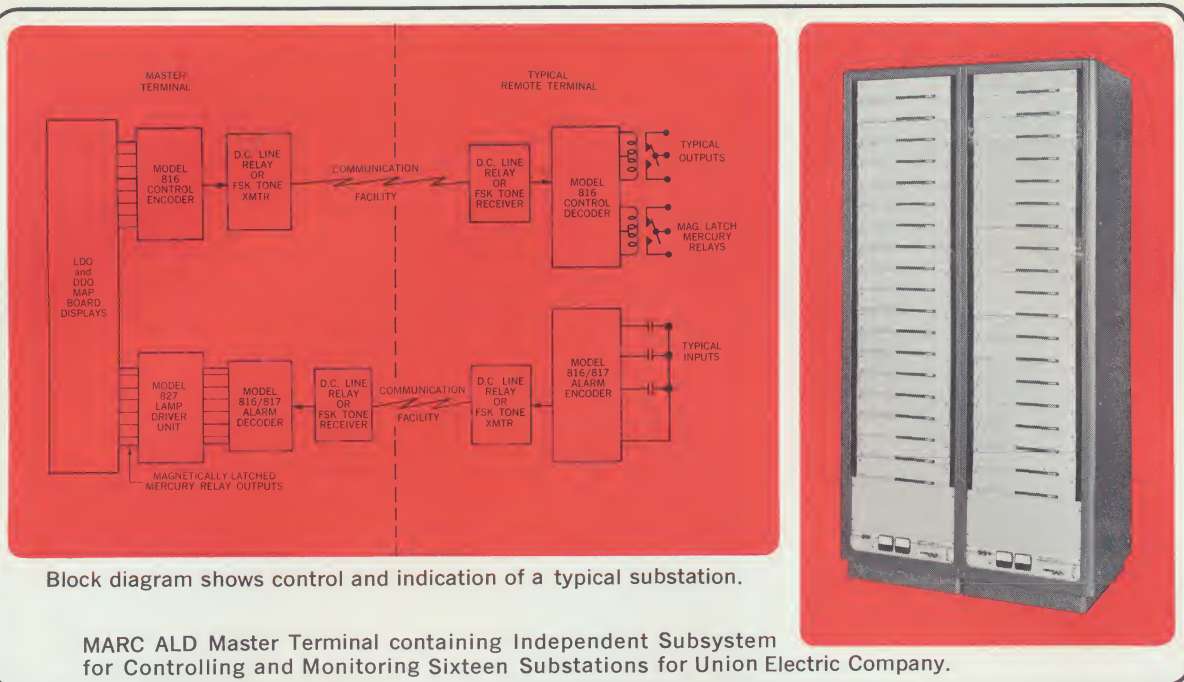
The Input Relay Buffer (A) is designed primarily to protect the solid-state encoder from substation voltage transients and to consolidate the alarms and indications for transmission by the encoder. Switching operations at typical substations can produce sufficient transients to disturb or even damage transistorized equipment. The buffer unit contains one reed relay per indication or alarm input, mounted on plug-in printed circuit cards.

The Encoder (B) and Decoder (E) are the heart of each MARC ALD System. The encoder continuously scans the alarm inputs as reproduced by the relays in the input relay buffer, and generates a serial pulse code, each pulse representing the status of one of the inputs. At the decoder the pulse code is decoded and the alarms and indications are passed to the output storage unit. However, before the information is passed to the output storage unit, stringent checks are made to insure that noise and other disturbances from the communication line have not distorted the pulse code and produced false alarms. The principal error-checking circuits are: a) the Signal Monitor, which rejects pulses which are longer or shorter than acceptable limits; b) the Error

Detector, which requires that a group of 16 or 32 pulses, from 16 to 32 inputs, be received at the decoder without change on two successive scans by the encoder. Any error, which will make one scan transmission disagree with the next transmission, causes the error detector to reject the information.

The frequency-shift-keyed tone channel (C & D) transmits the pulse code from the encoder to the decoder over Tampa Electric Company's private voice lines. FSK tone channels were chosen, over amplitude-modulated or phase-shift tone channels, because of their superior signal-to-noise ratio when operating in an environment which contains heavy random impulse noise. At a future time, some microwave circuits will also be used for transmission. The tone channel is the only part of the system requiring any adjustment by maintenance personnel. On installation, and subsequently if the communication line is changed, the channel must be adjusted for the line characteristics. A simple test set is supplied for this adjustment.

The Output Storage Unit (F) receives the alarm and indication information from the decoder and lights the appropriate lamps on Tampa Electric Company's map board display panel. All lamps are driven from mercury-wetted-contact relays. In view of the large numbers of alarms and indications involved (100 from the largest substation), a flashing indication of each change is provided to enable the operator to pinpoint the situation as soon as the audible alarm announces a change. Operation of a common reset button silences the alarm and changes the flashing indication to steady. An optional feature is included by which the sounding of the alarm may be delayed for several seconds on all alarms.



Modernized Supervisory Control System for Union Electric Company

The Union Electric Company serves a power network covering parts of Missouri, Illinois, and Iowa from headquarters in St. Louis, Missouri. As part of a continuous updating program, the Company has installed a computer controlled economic load dispatch and a modernized supervisory indication control system, the latter at fifteen substations located in the St. Louis area, and one remote from St. Louis, at the Company's Taum Sauk Pumped Hydro Plant. A microwave radio relay system is used to carry Taum Sauk supervisory indication to the St. Louis Load Dispatch Center.

The economic load dispatch employs an analog computer for load data retrieval and load control. Installation of a digital computer is planned for later in 1965. Moore Associates solid-state MARC ALD equipment is used to provide remote monitoring of the status of substation apparatus; such as the OCB position, high speed ground switch, motor-operated disconnect switch position, etc. It also indicates alarm situations, such as low battery voltage, loss of station service, low oil, high temperature, transformer or feeder lockouts. While the basic installation involves just 16 substations, expansion can be accomplished at the dispatch control office by mere addition of circuit cards. The MARC ALD multiplex units were arranged so that each substation can be monitored and controlled without reference to any other substations. The only common units used are the main and standby power supplies at the dispatch control office.

The Union Electric LDO map board, a portion of which can be seen in the photograph on the cover of this bulletin, is roughly semicircular and covers over 1000 square feet. It is "metalized pegboard" to provide simplified mounting of all alarm and mimic bus devices, and to allow the map board to be easily modified for future requirements. Alarm devices for all OCB's, ACB's, and Switches contain dual lamp units, with one lamp flashing when the monitored apparatus changes status. Operator acknowledges

changes by depressing "reset" pushbutton, which is common to all alarms from a particular substation. This action causes the flashing lamp to extinguish and allows the actual condition of the monitored point to be displayed, as the complementary lamp assumes a continuously lit state.

The LDO map board alarm devices; for lockout, low pressure, undervoltage, etc. points; each contain a single lamp which flashes whenever the monitored point changes its status. Operator acknowledgment causes the lamp to remain lighted when the point is in "alarm" and to extinguish when the point is "normal."

While Union Electric Company was concerned with supervisory system reliability, it was also faced with a space problem at the dispatch office. Normally these would appear to be conflicting requirements, but the separate and independent MARC ALD units, for controlling four substations and monitoring sixteen substations, were all mounted within the 84" H x 48" W x 24" D cabinet shown above, along with four lamp and two logic power supplies.

The presently installed MARC ALD Systems provide an aggregate equipped capacity of 20 controls and 133 alarm indications. Expansion for an additional 12 controls and 123 indications is easily accomplished by means of plug-in building block modules. The specific MARC ALD units supplied to Union Electric Company are as follows:

- Model 816A Encoders (16 points)
Alarm & Control Transmission
- Model 817A Encoders (32 points)
Alarm Transmission
- Model 816B Decoders (8 points)
Alarm & Control Reception (816B/D)
- Model 816C Decoders (16 points)
Alarm & Control Reception (816C/E)
- Model 817B Decoders (32 points)
Alarm Reception
- Model 827 Lamp Driver Units
Alarm Display

Other Power Utility Applications

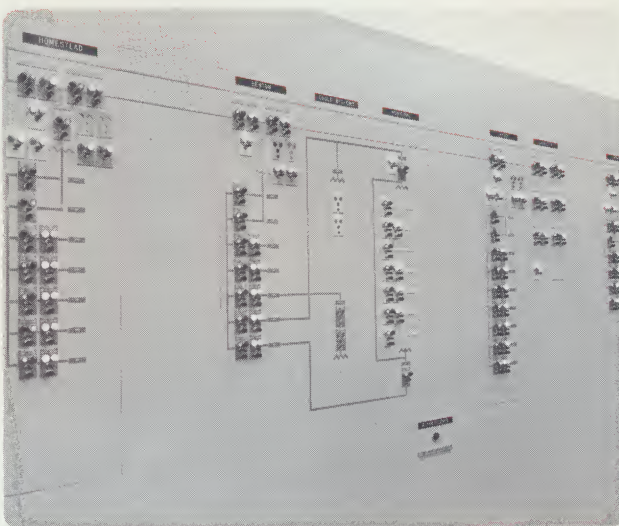
For Power Generation

ON LINE and OFF LINE Computer Operated Supervisory Control and Data Gathering for Hydroelectric Generating Stations. Moore Associates' MARC equipment provides internal programming as required, and interfaces directly to the computer for ON LINE applications. OFF LINE interface may be card, tape, or typed log.



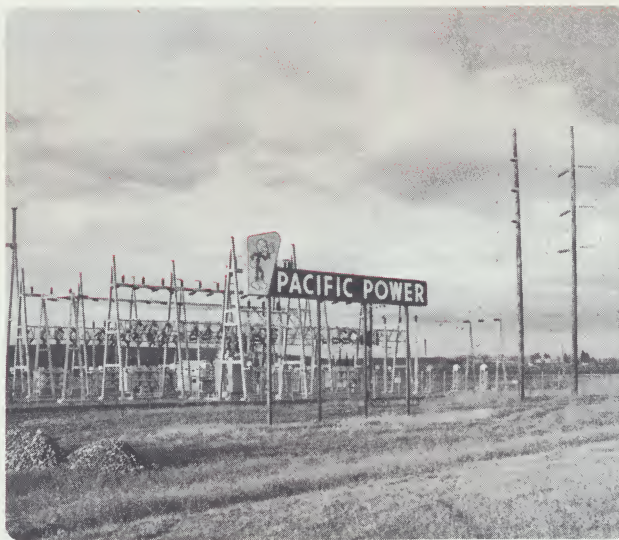
For Routine Substation Supervisory Control

Illustration at right shows typical MARC Supervisory Control, as developed by Moore Associates for a power company's substations. Conventional escutcheon/mimic bus arrangement is presented to the operator. The system is completely solid state for maximum reliability and convenience.



For Emergency Substation Alarm and Control

VHF/UHF Radio Shared Time Supervision and Control of Remote Sites. In accordance with FCC rules, transmission of alarm and control information is limited to six seconds out of each minute, with a maximum of three transmissions for each change of state of the supervised device. The radio channel is otherwise available for normal voice communication.



MOORE ASSOCIATES, INC.



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EQUIPMENT ENCLOSURES FOR ALL MARC SYSTEMS



Recognizing the need for economical, attractive enclosures, suited environmentally to a wide variety of applications, Moore Associates produces a line of functionally designed housings for MARC alarm, control, and telemetering systems. These highly practical housings contribute materially to the modern, orderly appearance of control centers, dispatchers' offices, and computer rooms in installations throughout the world.

This catalog, 6505A, has been prepared to display by size and type the more frequently specified enclosures available with MARC systems. MARC equipment described in other catalogs may be ordered premounted and interconnected in any of these enclosures, ready for indoor or outdoor installation.

Mounting

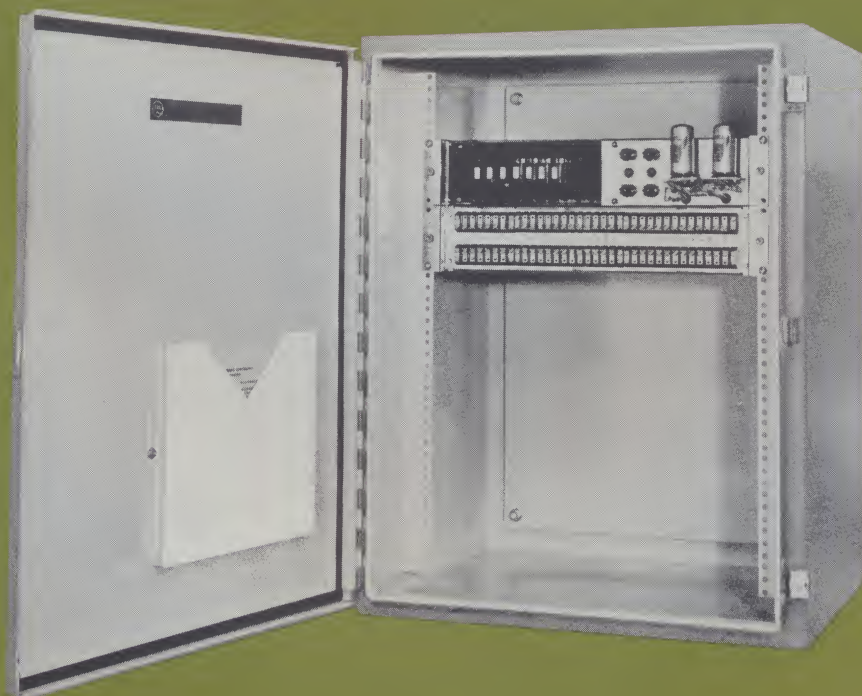
When an equipment enclosure is ordered con-

current with a system, the applicable equipment will be mounted in the enclosure, and interconnection between various units will be made at the factory through the use of multi-pin connectors. Jack screws are provided on multi-pin connectors, to permit rapid exchange of chassis and more permanent connection without danger of connectors becoming loose. Customer connections will be made on the equipment chassis, as specified in the MARC equipment specification. Extension of the customer connections to a separate panel, annunciating fuse blocks, etc. will be provided on special order.

Shipping

Enclosures less than 36" in height will be crated and shipped as specified in the order. Enclosures larger than 36" will be shipped by furniture van uncrated; with all equipment modules racked and interconnected.

Fig. 1 Model 4070 NEMA 12 enclosure for wall mount. 2 3/8" dia. cable entry hole in bottom is normally supplied for customer wiring access.



SPECIFICATIONS

NEMA 1 (General Purpose) enclosures are available in three basic sizes. Enclosure frame for free-standing cabinet is 14-gauge, doors and panels** are 16-gauge steel. Enclosures can be supplied in other sizes and with sloped-face panels on special order. All cabinets finished in smooth metallic dark grey.

Figure 2 — NEMA 1 General Purpose enclosure. Free standing Model 4329 and 4330 are supplied as shown with full length front and rear doors.

Figure 3 — Model 4328 for desk top installation. Filler panels are provided for the portion of 21" panel space unused.

Figure 4 — Model 4038 NEMA 12 enclosure with front and rear access doors. This unit and Model 4070 (Fig. 1) are also available as NEMA 3 enclosures equipped with sun shields.

Figure 5 — Typical NEMA 3 enclosure for outdoor installation with full exposure to weather. Model 2718-1 includes 12" high stand as standard equipment. Note sunshields.

NEMA 12 (Indoor) and **NEMA 3** (Outdoor) enclosures are available in two basic sizes. All NEMA 12 and NEMA 3 cabinets also meet the requirements of NEMA 5 (Dust-Tight). Body is all-welded construction 14-gauge steel. Enclosures can be supplied in various other sizes on special order. All cabinets are finished with ASA61 Light Grey smooth paint.

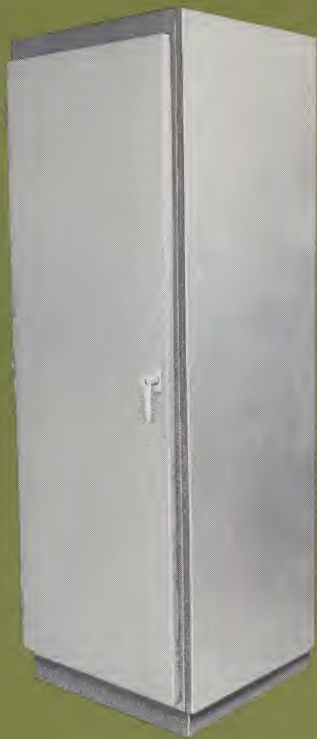


Fig. 2



Fig. 3

MODEL	REF. FIGURE	MAXIMUM DIMENSIONS				CABLE ENTRY	REMARKS
		Height	Width	Depth	Rack Space		
4330	2	87¼"	22½ ₁₆ "	*27½"	78¾"	Bottom open	Front and rear doors with locking handles
4329	2	52¼"	22½ ₁₆ "	*24½"	43¾"	Top removable	
4328	3	25"	25"	17"	21"	Same	Desk top mounting, fill panels provided

* Excluding protrusion of door handles

** Fill panels not provided when cabinets are equipped with front and rear doors

MODEL	REF. FIGURE	MAXIMUM DIMENSIONS				CABLE ENTRY	LATCH STYLE	REMARKS
		Height	Width (door side)	Depth	Rack Space			
Nema 12								
4070	1	30"	24"	21½"	26¼"	1 ea. bottom 2⅝" dia.	Clamp & Padlock holes	Single Door-Wall Mount
4038	4	30"	25"	22"	26¼"	1 ea. bottom 2⅝" dia.	Clamp & Padlock holes	Front & Rear Doors—Wall Mount
2718-2	—	84"	24"	* 21½"	68¼"	Removable Base Plate 14" x 16"	3 point latch & handle, padlock holes	Single Door—Floor Mount on 12" high stands (supplied)
Nema 3 (with sun shields)								
4326	—	32"	28"	23"	26¼"	1 ea. bottom 2⅝" dia.	Clamp & Padlock holes	Single Door-Wall Mount
4327	—	32"	27"	24"	26¼"	1 ea. bottom 2⅝" dia.	Clamp & Padlock holes	Front & Rear Doors—Wall Mount
2718-1	5	86"	28"	26"	68¼"	Removable Base Plate 14" x 16"	3 point latch & handle, padlock holes	Single Door—Floor Mount on 12" high stands (supplied)



Fig. 4

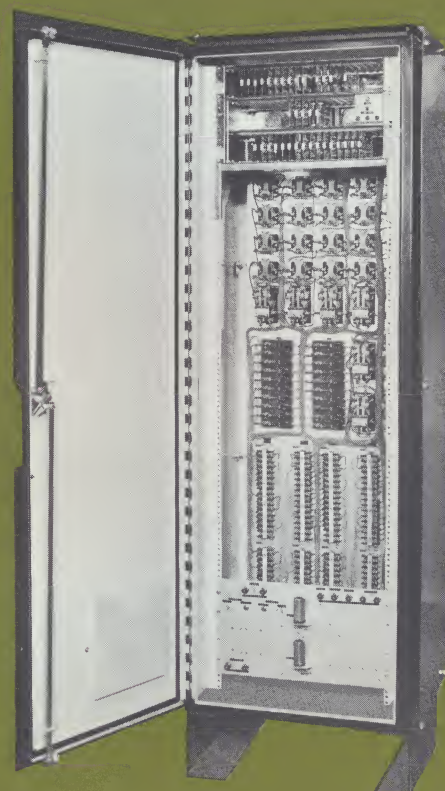


Fig. 5

Custom

Enclosures with desks, control/display panels, inset printers and other special arrangements will be supplied on special order. Figures 6 through 9 show some of the possible configurations. Consult the factory for special requirements. Heating and cooling requirements can also be met in accordance with customers' special order.

Figure 6 — Special NEMA 12 enclosure for installations where space does not allow for 19" rack mounting. MARC system is mounted on an internal panel and alarm indications are brought through door.

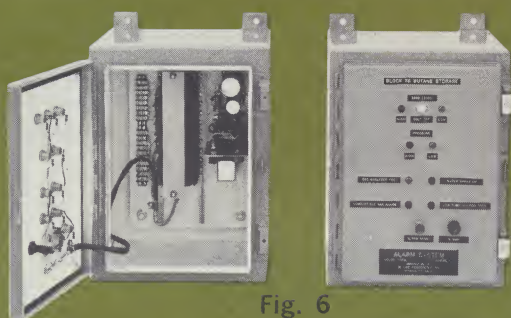


Fig. 6

Figure 7 — Free-standing double bay cabinet with distinctive shadow box trim. Similar to Model 4330 in construction, without front doors.



Fig. 7

Figure 8 — Class 1, Group D, Division 2 Explosion-Proof housings are also available for mounting versatile MARC systems.

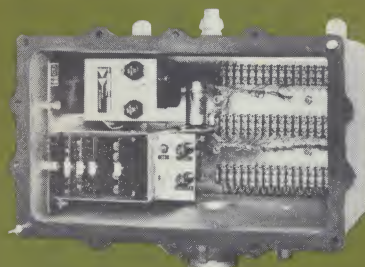


Fig. 8

Figure 9 — Custom cabinet with telemeter display in front door and swing-out rack feature for access to interconnections of multiplex. NEMA 12 construction. Cover plates in door provide precut spaces for future expansion of display.

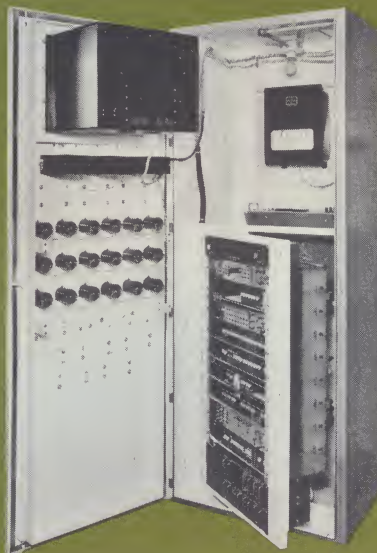


Fig. 9

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